REMARKS:

1) In view of the accompanying Request for Continued Examination (RCE), the final status of the Office Action of April 23, 2007 shall be withdrawn, and the Examination shall be continued on the basis of the present amended claims and remarks.

2) The Examiner's attention is directed to applicant's fifth Information Disclosure Statement that was filed by mail on May 14, 2007. Please consider the cited references and return an initialed, signed and dated acknowledgment copy of the IDS Form PTO-1449 of May 14, 2007.

3) The claims have been amended as follows.

Independent claim 1 has been amended to additionally recite that the first barrier layer consists of i-type ZnMgBeSe provided between the active layer and the p-type cladding layer, the active layer has a stacked structure including a quantum well layer and a second barrier layer, and the n-type cladding layer is formed of ZnMgSSe. These additional features are supported by prior claims 6 and 27, Fig. 10 of the drawings, and the specification at page 11 line 3, page 17 lines 10 and 11, and page 26 line 16.

Dependent claims have been amended wherever necessary for proper conformance with the amended independent claim, and for streamlining and uniformity of the claim terminology.

Claims 5 to 7, 11, 26 and 27 have been canceled.

New claims 28 and 29 have been added. Claim 28 is supported by Fig. 10 and claim 29 is supported by Figs. 1, 7 and 9, and thus do not introduce any new matter.

Entry and consideration of the claim amendments and the new claims are respectfully requested.

4) After the present amendment, claims 1, 3, 4, 12, 13 and 28 read on the elected species of Fig. 10. Claims 2, 14 and 15 remain withdrawn, and new claim 29 will presumably be withdrawn by the Examiner, because these claims are not directed to the elected species of Fig. 10. The non-elected claims depend from the generic independent claim. In the event a generic independent claim is ultimately found allowable, the Examiner is respectfully requested to rejoin, consider and allow the dependent non-elected claims.

5) Referring to pages 2 to 5 of the Office Action, the rejection of claims 1, 3 to 6, 11, 13 and 26 as obvious over US Patent 5,299,217 (Migita et al.) in view of US Patent 6,870,178 (Asryan et al.) and US Patent 5,747,827 (Duggan et al.) is respectfully traversed.

Currently amended independent claim 1 now recites a combination of additional features that further distinguish the invention over the prior art. Particularly, the first barrier layer consists of a single monolayer of an i-type ZnMgBeSe material provided between the active layer and the p-type cladding layer. The active layer is provided between the n-type cladding layer and the p-type cladding layer, and this active

layer has a stacked structure including a quantum well layer and a second barrier layer. Furthermore, the n-type cladding layer is formed of ZnMgSSe.

The above emphasized features provide a combination that is significant to the present invention. Namely, the active layer having a stacked structure including a quantum well layer and a second barrier layer is disposed between the n-type ZnMgSSe cladding layer and the p-type cladding layer, and the i-type ZnMgBeSe first barrier layer is disposed between the stacked active layer and the p-type cladding layer. So the order of these layers involves the active layer (with a stacked multi quantum well structure) and then the first barrier layer (of i-type ZnMgBeSe), between the n-type cladding layer of ZnMgSSe and the p-type cladding layer.

This structural arrangement and combination of features effectively limits or hinders the movement of electrons (which have been implanted into the active layer) from the active layer to the p-type cladding layer, due to the potential barrier provided by the first barrier layer (see the present specification at page 5 line 21 to page 7 line 10, page 17 lines 15 to 22, page 26 lines 16 to 28, etc.). As a result, the operating lifetime of the light emitting device is improved, without reducing or degrading the light emission characteristics. It has been found in accordance with the present invention, that the combination of the particular features emphasized above is significant for achieving this improvement of the operating lifetime without reducing the light emission characteristics. For example, when the first barrier layer is particularly formed

of ZnMgBeSe (rather than other materials such as ZnMgSSe), a higher efficiency of electron confinement is achieved, and a smaller barrier against hole movement is formed (see page 7 lines 1 to 3 and 18 to 21, and page 17 line 15 to page 18 line 1). Also, by making the n-type cladding layer of ZnMgSSe, this ensures that the band gap of this cladding layer is larger than the band gap of the active layer, to surely prevent leakage of electrons from the active layer (see page 31 lines 26 to 28).

The references do not disclose such a combination of features, namely wherein the active layer having a stacked structure including a quantum well layer and a second barrier layer is disposed between the n-type ZnMgSSe cladding layer and the p-type cladding layer, and the i-type ZnMgBeSe first barrier layer is disposed between the active layer and the p-type cladding layer. Thus, the prior art could not have achieved or suggested such an effective blocking or limiting of the movement of electrons from the active layer to the p-type cladding layer. Accordingly, the prior art references could not have achieved (or suggested how to achieve) the present inventive advantage of an improved operating lifetime of the light emitting device without reducing the light emission characteristics.

Like prior claim 1, currently amended claim 1 requires an i-type barrier layer provided between the active layer and the p-type cladding layer. In the rejection, the Examiner acknowledges that Migita et al. do not disclose such a barrier layer. In this regard, the Examiner has referred to Asryan et al. as disclosing such a barrier layer (116). However, the Election Requirement of May 25, 2005 expressly asserts that a

species having a barrier layer (present Fig. 10) and a species not having a barrier layer (present Fig. 14) are patentably distinct species. Similarly, the species according to Asryan et al. having a barrier layer is patentably distinct from the species of Migita et al. not having a barrier layer, and a person of ordinary skill in the art would not have been motivated to combine such patentably distinct features. By definition, patentable distinction is based on features or differences that would not have been within the ordinary level of skill and knowledge. Furthermore, the barrier layer (116) of Asryan et al. is not even a group II/VI semiconductor material, but instead is a group III/V material. Still further, the barrier layer (116) is not arranged directly in contact with a p-type cladding layer as required by present claim 1. As such, not only is the structural arrangement different, but the function and operation of the layers are also significantly different from that of the present invention.

For further teachings in this regard, the Examiner has referred to Duggan et al. However, the barrier layer (58) of Duggan et al. is not a barrier layer consisting of a single monolayer of an i-type semiconductor material, but instead is a superlattice structure comprising stacked alternating layers of MgS and of ZnSe (col. 11 line 11). Thus, even a combination of all three references would not have suggested the present invention.

Currently amended independent claim 1 incorporates the feature from prior claims 6 and 27, that the first barrier layer consists of ZnMgBeSe. Regarding the prior claim 6, the Examiner

has acknowledged that Migita et al. even as modified by Asryan et al. and Duggan et al. did not disclose the material of the barrier layer being ZnMgBeSe.

Regarding the particular material of the barrier layer, the Examiner has asserted "*it would have been obvious . . . to form the barrier layer using ZnMgBeSe; at least to use a known and suitable material*". However, the Examiner has not shown that the prior art considers ZnMgBeSe to be "*a known and suitable material*" for an i-type barrier layer having the band gap as presently claimed and being arranged between the active layer and the p-type cladding layer as presently claimed, in currently amended claim 1. In fact, the Examiner has not pointed out any prior art reference disclosing or suggesting such a material for a barrier layer as presently claimed.

As discussed above, the present application demonstrates that a barrier layer of ZnMgBeSe achieves improved results (e.g. increased operating lifetime without reducing the light emission) in comparison to other materials such as ZnMgSSe (see the present specification at page 7 lines 1 to 3 and lines 18 to 21, page 17 line 15 to page 18 line 1, and page 26 lines 16 to 28; and Fig. 11 in comparison to Fig. 12). Namely, a comparison of present Figs. 11 and 12 shows why ZnMgBeSe is advantageous for the first barrier layer, because thereby it is possible to form a barrier against electron leakage from the active layer to the p-type cladding layer without forming a barrier against the motion of holes from the p-type cladding layer to the active layer (Fig. 11). Other barrier layer materials such as ZnMgSSe (Fig. 12) would form a barrier against hole migration as well,

thereby diminishing the effect of the p-type cladding layer to supply holes to the active layer for improving the light emission.

Thus, the ZnMgSSe material of the superlattice barrier (58) according to Duggan et al. would have had a significantly different (and worse) functionality than the ZnMgBeSe material of the presently claimed barrier layer. There would have been no suggestions or expectations in the prior art to significantly improve the device performance by using ZnMgBeSe instead of ZnMgSSe for the barrier layer because the prior art is silent in this regard.

For the above reasons, the invention of currently amended independent claim 1 would not have been obvious from the combination of references. The dependent claims are patentably distinguishable already due to their dependence. The Examiner is respectfully requested to withdraw the rejection of claims 1, 3 to 6, 11, 13 and 26 as obvious over Migita et al. in view of Asryan et al. and Duggan et al.

6) Referring to pages 5 and 6 of the Office Action, the rejection of claims 12 and 27 as obvious over Migita et al. in view of Asryan et al. and Duggan et al., and further in view of US Patent 6,555,403 (Domen et al.) is respectfully traversed. Claim 27 has been canceled. Claim 12 depends from claim 1, which has been discussed above in comparison to Migita et al. in view of Asryan et al. and Duggan et al. Domen et al. has additionally been cited regarding the layer thickness of a barrier layer. However, the Examiner has acknowledged that Migita et al. as modified by

Asryan et al., Duggan et al. and Domen et al. still does not disclose the barrier layer being formed of ZnMgBeSe. The Examiner has asserted that this features would have been obvious "*at least to use a known and suitable material*". However, as discussed above, the Examiner has not pointed out any prior art that suggests using ZnMgBeSe as "*a known and suitable material*" for a barrier layer in the presently claimed arrangement. To the contrary, the present application has demonstrated that ZnMgBeSe is superior to conventional barrier layer materials such as ZnMgSSe, and such superior performance would not have been expected from the prior art. Thus, even a combination of all four references would not have made the invention of present claim 1 and its dependent claim 12 obvious. The Examiner is respectfully requested to withdraw the obviousness rejection of claims 12 and 27.

7) Favorable reconsideration and allowance of the application, including all present claims 1 to 4, 12 to 15, 28 and 29, are respectfully requested.

Respectfully submitted,
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By Walter F. Fasse

WFF:he/4685
Enclosures:
Transmittal Cover Sheet
RCE
Term Extension Request
Form PTO-2038

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